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# THE EFFECTS OF PRESERVATION SOLUTIONS ON MORPHO-DECORATIVE CHARACTERISTICS OF *DAHLIA VARIABILIS* CUT FLOWERS

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**Abstract:** *Dahlia* (family Asteraceae) is particularly popular in interior decoration as a cut flower or in various floral arrangements. The aim of this study was to highlight the effect of different preservative solutions on keeping dahlia flowers in vases. The experiment was conducted in 2015 in the laboratory of the Horticultural Products Technology Laboratory of the Horticultural Faculty of USAMV Cluj-Napoca.

Research was carried out on the vase life of *Dahlia* cultivars with cactus-type flowers – 'Kennemerland', 'Tsuki Yori No Sisha', 'Hayley Jane', 'Purple Gem', 'Veritable', 'Star Favourites', 'Park Princess' and 'Friquolet' – in three preservative solutions: Fleur'Eau, Flower Time and Compo, compared with tap water as a control.

The results highlight the cultivar 'Kennemerland' as having the best response in storage in preservative solutions. Varieties kept in 'Flower Time' solution gave the best results. Regarding the appearance of leaves on the flower stems, cultivar 'Friqoulet' gave the best results, followed by cultivars 'Kennemerland', 'Hayley Jane' and 'Veritable', in the conservation solution 'Flower Time'.

**Keywords:** cultivar, flower characteristics, leaves, preservative solutions, storage.

## Introduction

Indoors and outdoors, dahlias are widely grown for cut flowers or ornament [5].

Among the assortment of cut flowers available in the summer to autumn period, *Dahlia* (Asteraceae) has gained a very significant advantage, given the number of flower per stem (15–20, depending upon the variety), harvested from a plant during the growing season [12]. *Dahlia* has the inflorescence (capitulum) composed of small tubular flowers, yellow in the centre, with ligulate flowers arranged in a row surrounding the flower disc and of various colours [1]

The decorative appearance of the flowers depends on numerous quality elements, so the flowers of dahlias should be uniform in size, arranged harmoniously on stalks long and strong enough to take them away from the leaves and set these out of sight, and flowers that are diverse and colourful [10].

The colour of flowers, their special shape and long storage period, make *Dahlia* one of the most popular species used as cut flowers for summer bouquets [3].

The varieties that are suitable for interior decoration are those with cactus-type flowers, chrysanthemum-type, and with a collar. It is recommended that harvesting of flowers is carried out when the blooms are semi-open.

Arranging flowers in vases or baskets is done as loosely as possible, without foliage, so that each flower stands out. For green foliage, 'asparagus fern' shoots or leaves from other species can be used [1].

In Japan, cut flowers of *Dahlia* have been popular in recent years due to the red-black variety 'Hokucho' which has stimulated the demand among traders of dahlias. A short vase life (5–7 days) has reduced expansion of the demand for cut flowers of *Dahlia* [11].

The quality of water can have a significant impact on the life of cut flowers in a vase. Cut flowers are often placed in tap water, which, depending on the source, may contain various chemicals, organic matter and microorganisms, and the pH can vary. A low pH slows the growth of bacteria and improves water absorption in strains [4].

Regan and Dole (2010) recorded that the optimal vase life of cut flowers of the roses 'Freedom', 'Charlotte' and 'Classy' corresponds to a pH of 3.1–4.0.

Sugars also prolong the vase life of cut flowers. For the cut flowers of *Dahlia* 'Purple Gem', a solution of 10% glucose + silver nitrate slightly extends the vase life [8].

Dole et al. (2009) affirm that commercial conservation solutions extend the vase life of cut flowers of *Dahlia* 'Eveline' and 'Karma Thalia', but shorten their cold storage preservation.

A study by Shimizu-Yumoto and Ichimura, (2013) found that 6-Benzylaminopurine is more efficient than ethylene in delaying the senescence of cut flowers of *Dahlia*.

**Material and Methods**

The experiment was conducted in 2015 in the laboratory of Horticultural Products Technology Laboratory of the Horticultural Faculty of USAMV Cluj-Napoca.

The biological material studied derives from the Botanical Garden of the University of Agricultural Sciences and Veterinary Medicine, Cluj-Napoca, and consisted of eight varieties of *Dahlia variabilis*.

Cultivars represented the factor A: $a_1$ – 'Kennemerland', $a_2$ – 'Tsuki Yori No Sisha', $a_3$ – 'Hayley Jane', $a_4$ – 'Purple Gem', $a_5$ – 'Veritable', $a_6$ – 'Star Favorite', $a_7$ – 'Park Princess', $a_8$ – 'Friquolet'.

The cultivars were put into four preservation solutions (factor B): $b_1$ – tap water (control), $b_2$ – Fleur'Eau, $b_3$ – Flower Time, $b_4$ – Compo (Figure 1).

The combination of these two factors, with eight cultivars and four treatments, produced 32 experimental combinations.

Into each preservative solution were placed three flower stems of each cultivar in four repetitions, a total of 96 flower stems.

Harvesting was carried out by cutting the flower stems above 2–4 leaves at the base (1–2 nodes) at the semi-open inflorescence phase.

The flower stems, before being put into the containers, were cut obliquely to increase the absorption surface for the conservation solution.

The temperature of the laboratory in which the experiment was set up was 20–22$^{o}$C.



**Fig. 1: Experimental material of *Dahlia variabilis***

The capacity of the containers in which the flower stems were preserved was 500 ml. In each container was put an amount of 250 ml of conservation solution and tap water respectively, which at 2-day intervals was corrected to the initial level, and the cut in the bottom of the stems was refreshed.

The pH of the three preservative solutions: Fleur'Eau (4.5), Flower Time (4.5), Compo (6.0), and the tap water (6.0), was determined using litmus paper (Figure 2).




**Fig. 2: Determination of solution pH**

Regarding the appearance of leaves on the flower stems were graded from 1 to 3 as follows:

1 = Very good,

2 = Good,

3 = Satisfactory.

The results were statistically interpreted using Duncan's Multiple Range test [2].

## Results and Discussion

The influence of conservation solutions on the shelf life of dahlias as cut flowers is shown in Table 1. This demonstrates statistically significant differences among the four preservation solutions over the eight cultivars of *Dahlia variabilis*.

**Table 1: Influence of conservation solutions on the duration of storage of *Dahlia* flowers**

| No. Var. | Variant | | Vase life (days) |
|---|---|---|---|
| | Preservation solution | Cultivar | |
| $V_1$ | Tap water (Control) | 'Kennemerland' | 12.33 ab |
| $V_2$ | | 'Tsuki Yori No Sisha' | 7.67 l |
| $V_3$ | | 'Hayley Jane' | 11.33 defgh |
| $V_4$ | | 'Purple Gem' | 9.33 hijk |
| $V_5$ | | 'Veritable' | 10.33 fghij |
| $V_6$ | Fleur' Eau | 'Star Favorite' | 9.67 ghijk |
| $V_7$ | | 'Park Princess' | 7.67 jk |
| $V_8$ | | 'Friquolet' | 8.33 ijk |
| $V_9$ | | 'Kennemerland' | 12.00 abcd |
| $V_{10}$ | | 'Tsuki Yori No Sisha' | 8.00 ijk |
| $V_{11}$ | | 'Hayley Jane' | 11.33 cdefg |
| $V_{12}$ | | 'Purple Gem' | 10.33 efghi |
| $V_{13}$ | | 'Veritable' | 11.67 abcde |
| $V_{14}$ | Flower Time | 'Star Favorite' | 11.0 defgh |
| $V_{15}$ | | 'Park Princess' | 8.33 ijk |
| $V_{16}$ | | 'Friquolet' | 8.67 hijk |
| $V_{17}$ | | 'Kennemerland' | 14.00 ab |
| $V_{18}$ | | 'Tsuki Yori No Sisha' | 11.33 bcdef |
| $V_{19}$ | | 'Hayley Jane' | 11.67 bcdef |
| $V_{20}$ | | 'Purple Gem' | 12.00 abcd |
| $V_{21}$ | | 'Veritable' | 13.00 ab |
| $V_{22}$ | | 'Star Favorite' | 12.00 abc |
| $V_{23}$ | | 'Park Princess' | 9.00 hijk |
| $V_{24}$ | | 'Friquolet' | 9.33 ghijk |
| $V_{25}$ | Compo | 'Kennemerland' | 15.67 a |
| $V_{26}$ | | 'Tsuki Yori No Sisha' | 10.33 efghi |
| $V_{27}$ | | 'Hayley Jane' | 11.67abcde |
| $V_{28}$ | | 'Purple Gem' | 10.00 ghijk |
| $V_{29}$ | | 'Veritable' | 11.00 efghi |
| $V_{30}$ | | 'Star Favorite' | 10.00 fghij |
| $V_{31}$ | | 'Park Princess' | 7.67 kl |
| $V_{32}$ | | 'Friquolet' | 7.33 m |

Variant $V_{25}$ ('Kennemerland' / Compo) with a total number of 15.67 days of storage in the conservation solution is significantly different in statistical terms than the variants $V_2$, $V_3$, $V_4$, $V_5$, $V_6$, $V_7$, $V_8$, $V_{10}$, $V_{11}$, $V_{12}$, $V_{14}$, $V_{15}$, $V_{16}$, $V_{18}$, $V_{19}$, $V_{23}$, $V_{24}$, $V_{26}$, $V_{28}$, $V_{29}$, $V_{30}$, $V_{31}$, $V_{32}$, variant $V_{32}$ ('Friquolet' / Compo) having the lowest number of days of storage (7.33 days).

Among variants $V_1$ ('Kennemerland' / Tap water) $V_9$ ('Kennemerland' / Fleur'Eau), $V_{13}$ ('Veritable' / Fleu'Eau), $V_{17}$ ('Kennemerland' / Flower Time), $V_{20}$ ('Purple Gem' / Flower Time),

$V_{21}$ ('Veritable' / Flower Time), $V_{22}$ ('Star Favorites' / Flower Time), $V_{25}$ ('Kennemerland' / Compo) and $V_{27}$ ('Hayley Jane' / Compo) there is no assured statistical difference, but there are differences, the highest value being assigned to variant $V_{25}$ (15.67 days), followed by variant $V_{17}$ (14.00 days), $V_{21}$ (13.00 days), $V_1$ (12.33 days), $V_9$, $V_{20}$, $V_{22}$ (12.00 days) and $V_{13}$ , $V_{27}$ (11.67 days).

The lower value (7.33 days) specific to variant $V_{32}$ ('Friquolet' / Compo) makes this variant significantly different and inferior to other variants from $V_1$-$V_{31}$.

The variants $V_1$, $V_{17}$, $V_{21}$ form a homogeneous group symbolized by the letters "ab", the differences recorded between them are insignificant, but significantly different from the homogeneous groups "hijk" ($V_4$, $V_{16}$, $V_{23}$), "ghijk" ($V_6$, $V_{24}$, $V_{28}$) and "efgh" ($V_{12}$, $V_{26}$, $V_{29}$).

The cultivar 'Kennemerland' was best preserved in the preservation solution Compo (15.67), followed by conservation solutions Flower Time (14.00 days), and Fleur'Eau (12.00 days).

In Figure 3, it can be observed that the average value (11.54 days) of eight cultivars in preservation solution Flower Time is higher than the other solutions.

Similar results were obtained by Dole et. al., 2005 with cut flowers of *Dahlia* 'Karma Thalia'. The flower stems of *Dahlia* harvested at the full opening phase had a lifetime of 7–10 days in de-ionized water vases, which was increased by 1.5–2 days using commercial solutions (Chrysal Professional 2 Processing Solution and Floralife Professional ). Cold storage at 10$^{o}$C for one week reduced the vase life by up to 2 days. The longest vase life (12–13 days) was achieved when the flower heads/buds show 50% of the colour typical of the variety and flower stems are harvested when one petal is open and placed in solutions containing 2–4% sucrose or preservative solutions.

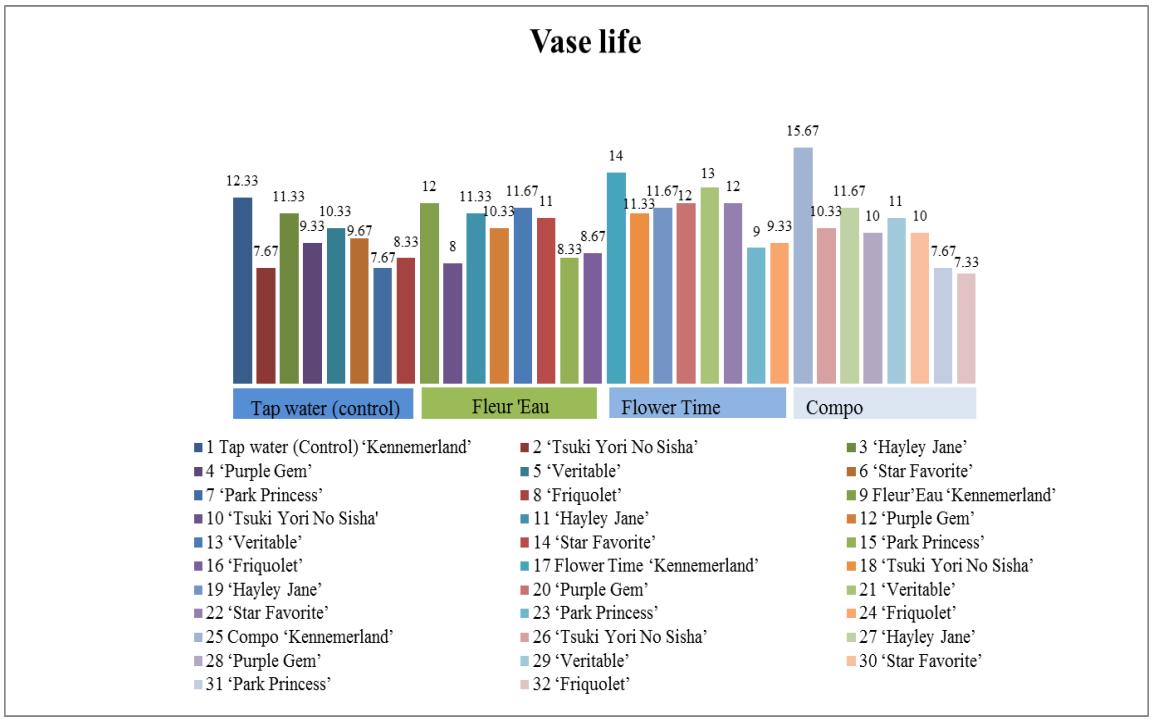



**Fig. 3: The storage period of *Dahlia variabilis* cultivars in conservation solutions**

**The influence of conservation solutions on the appearance of leaves on the stem**

The results presented in Table 2, on the appearance of leaves on the stem, revealed that the eight cultivars behaved differently in the four preservation solutions.

**Table 2: The influence of conservation solutions on the appearance of leaves on the stem**

| No. Var. | Variant | | Average value of evaluation marks |
|---|---|---|---|
| | Preservative agent | Cultivar | |
| $V_1$ | Tap water (Control) | 'Kennemerland' | 2.67 ab |
| $V_2$ | | 'Tsuki Yori No Sisha' | 2.33 ab |
| $V_3$ | | 'Hayley Jane' | 3.00 a |
| $V_4$ | | 'Purple Gem' | 1.00 e |
| $V_5$ | | 'Veritable' | 1.33 cde |
| $V_6$ | | 'Star Favorite' | 1.67 bcd |
| $V_7$ | | 'Park Princess' | 1.00 e |
| $V_8$ | Fleur'Eau | 'Friquolet' | 3.00 a |
| $V_9$ | | 'Kennemerland' | 1.33 bcd |
| $V_{10}$ | | 'Tsuki Yori No Sisha' | 2.00 ab |
| $V_{11}$ | | 'Hayley Jane' | 1.33 bcd |
| $V_{12}$ | | 'Purple Gem' | 1.33 de |
| $V_{13}$ | | 'Veritable' | 2.00 ab |
| $V_{14}$ | | 'Star Favorite' | 2.00 abc |
| $V_{15}$ | | 'Park Princess' | 1.33 de |
| $V_{16}$ | | 'Friquolet' | 2.67 ab |
| $V_{17}$ | Flower Time | 'Kennemerland' | 2.67 ab |
| $V_{18}$ | | 'Tsuki Yori No Sisha' | 1.67 bcd |
| $V_{19}$ | | 'Hayley Jane' | 1.33 cde |
| $V_{20}$ | | 'Purple Gem' | 1.00 e |
| $V_{21}$ | | 'Veritable' | 2.67 ab |
| $V_{22}$ | | 'Star Favorite' | 2.33 ab |
| $V_{23}$ | | 'Park Princess' | 1.33 de |
| $V_{24}$ | | 'Friquolet' | 3.00 a |
| $V_{25}$ | Compo | 'Kennemerland' | 2.33 ab |
| $V_{26}$ | | 'Tsuki Yori No Sisha' | 1.67 abc |
| $V_{27}$ | | 'Hayley Jane' | 1.33 de |
| $V_{28}$ | | 'Purple Gem' | 1.33 de |
| $V_{29}$ | | 'Veritable' | 2.00 abc |
| $V_{30}$ | | 'Star Favorite' | 1.33 cde |
| $V_{31}$ | | 'Park Princess' | 1.67 abc |
| $V_{32}$ | | 'Friquolet' | 2.67 ab |

The highest values were obtained by variants $V_3$ ('Hayley Jane' / Tap water), $V_8$ ('Friquolet' / Tap water) and $V_{24}$ ('Friquolet' / Flower Time). Between these three variants differences are not statistically assured, but no value differences, all have the same value (3.00), but are significantly different to variants $V_4$, $V_5$, $V_6$, $V_7$, $V_9$, $V_{11}$, $V_{12}$, $V_{15}$, $V_{18}$, $V_{19}$, $V_{20}$ , $V_{23}$, $V_{27}$, $V_{28}$, $V_{30}$.

Insignificant differences are recorded between variants $V_1$, $V_2$, $V_{10}$, $V_{13}$, $V_{16}$, $V_{17}$, $V_{21}$, $V_{22}$, $V_{25}$ and $V_{32}$ forming a homogeneous group symbolized by the letters "ab", but are significantly different than variants $V_4$, $V_5$, $V_7$, $V_{12}$, $V_{15}$, $V_{19}$, $V_{20}$, $V_{23}$, $V_{27}$, $V_{28}$, $V_{30}$.

Variants $V_4$ ('Purple Gem' / Tap water) $V_7$ ('Park Princess' / Tap water) and $V_{20}$ ('Purple Gem' / Flower Time) with the lowest value 1.00, present differences significantly inferior than the variants $V_1$, $V_2$ , $V_3$, $V_6$, $V_8$, $V_9$, $V_{10}$, $V_{11}$, $V_{13}$, $V_{14}$, $V_{16}$, $V_{17}$, $V_{18}$, $V_{21}$, $V_{22}$, $V_{24}$, $V_{25}$, $V_{26}$, $V_{29}$, $V_{31}$, $V_{32}$.

Among the variants $V_3$ ('Hayley Jane' / Tap water), $V_8$ ('Friquolet' / Tap water), $V_{24}$ ('Friquolet' / Flower Time) having a value of 3.00 and variants $V_1$ ('Kennemerland' / Tap Water), $V_{16}$ ('Friqoulet' / Fleur'Eau), $V_{17}$ ('Kennemerland' / Flower Time), $V_{21}$ ('Veritable' / Flower Time), $V_{32}$ ('Friquolet' / Compo) with a value of 2.67, there are differences in values, which are not statistically significant, the appearance of the leaves preserving best in the solution conservation (Flower Time) followed by the cultivars 'Kennemerland', 'Hayley Jane' and 'Veritable'.

## Conclusions

From the results obtained in the study conducted on the eight *Dahlia* cultivars, the following conclusions can be drawn:

With regard to the shelf life of cut flowers of *Dahlia* in preserving solutions, cultivar 'Kennemerland' preserved best, from 15.67 days (conservation solution Compo) to 12.00 days (conservation solution Fleur'Eau). It is recommended for use as a cut flower.

The preservation solution that recorded the highest average value was Flower Time.

Observing the appearance of leaves on the flower stems after evaluation, the best results were shown by the cultivar 'Friqoulet', followed by cultivars 'Kennemerland', 'Hayley Jane' and 'Veritable', in the conservation solution Flower Time.

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## EFECTELE SOLUŢIILOR DE CONSERVARE ASUPRA CARACTERELOR MORFO-DECORATIVE LA FLORILE TĂIATE DE *DAHLIA VARIABILIS*

**(Rezumat)**

*Dahlia* este deosebit de apreciată în decorul interioarelor ca floare tăiată sau în diferite aranjamente florale. Scopul acestui studiu a fost de a pune în evidenţă efectul soluţiilor conservante asupra păstrarii inflorescenţelor de dalia în vaze. Experimentul a fost realizat în 2015, în laboratorul de Tehnologia produselor horticole de la USAMV Cluj-Napoca.

Asupra cultivarelor de *Dahlia* luate în studiu aparţinând tipului de floare cactus: ‘Kennemerland’, ‘Tsuki Yori No Sisha’,‘Hayley Jane’, ‘Purple Gem’, ‘Veritable’, ‘Star Favorite’, ‘Park Princess’ şi ‘Friquolet’, s-au făcut cercetări privind durata de păstrare a acestora în trei soluţii de conservare: Fleur’Eau, Flower Time şi Compo, în comparaţie cu apa de la robinet considerată martor. Rezultatele obţinute pun în evidenţă cultivarul ‘Kennemerland’ ca având cea mai bună comportare fiind păstrat în soluţii conservante. Cultivarele păstrate în soluţia Flower Time au dat cele mai bune rezultate.

Privind aspectul frunzelor pe tulpinile florale, rezultatele cele mai bune le-a dat cultivarul ‘Friqoulet’, urmat de cultivarele ‘Kennemerland’, ‘Hayley Jane’ şi ‘Veritable’ în soluţia de conservare Flower Time.

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